# READ THIS MANUAL

PLEASE KEEP FOR PERMANENT REFERENCE

Part No. 115-2, Revised 1-17-03

This manual covers the preliminary installation, operation and general maintenance requirements for Aquafine Ultraviolet Water Treatment Equipment for the following applications:

- Disinfection
- Ozone
- TOC Reduction
- Chlorine/Chloramine Destruction

## RBE Series *Installation, Maintenance and Operation Manual*

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**SAFETY ISSUE**

It is imperative that those responsible for the installation of this equipment, as well as operating personnel, read this manual and carefully follow all instructions and guidelines. ***EQUIPMENT OPERATORS AND INSTALLERS MUST COMPLY WITH OPERATIONAL SAFETY REQUIREMENTS.***

Aquafine Corporation builds the finest quality ultraviolet equipment in the world. When properly installed and operated, Aquafine ultraviolet treatment units will provide many years of service.

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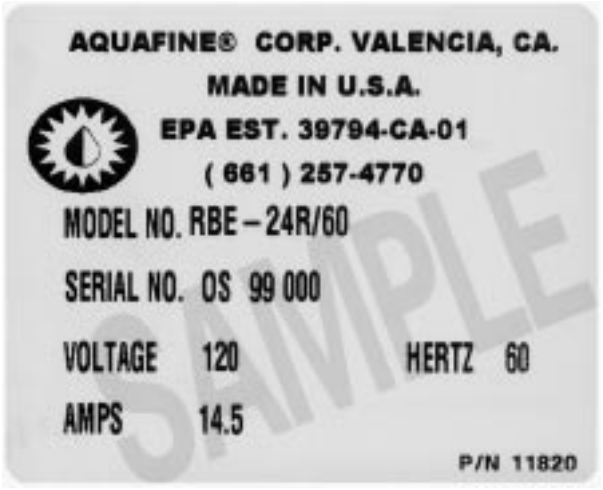
Refer to this nameplate sticker on your unit when ordering parts or service.

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# Installation and Operational Safety

## Safety requirements for UV equipment

The following safety requirements relate directly to operator safety. Please review with all appropriate personnel to ensure continuous compliance.

These safety requirements are MANDATORY. Failure to carefully follow these requirements can cause injury to the operator and damage the UV unit.

This "Safety Issue" icon marks all items relating to safety issues. Please read and adhere to these comments carefully.

1. Release the pressure in the UV treatment chamber before attempting to remove the protective covers and sealing items.
2. Disconnect all power to the UV unit before servicing. The unit operates on high voltage and should only be serviced by qualified personnel.
3. Do not look at the lighted blue ultraviolet lamps. Do not operate the ultraviolet lamps outside of the UV treatment chamber. Exposure can severely burn and damage eyes and skin.
4. Supply the unit with the correct voltage and frequency as indicated on the nameplate decal, ensuring the unit is wired in accordance with local electrical codes.
5. Properly ground the unit. Failure to comply may result in severe or fatal electrical shock.
6. Install the unit away from undue vibration that can damage the electrical components and UV lamps.
7. Ensure all water connections (flanges and compression nuts) are tightly sealed before applying pressure to the UV unit. **Do not stand in a direct line with the endplate when inspecting for water leaks; observe from the front or back.**
8. Do not allow the unit to overheat by operating without water flow. Normal operating temperature for standard UV units is 50° to 100°F (10°- 38°C). For high-temperature units, normal operating temperature is 50° to 150°F (10°- 66°C).
9. If the inlet water temperature exceeds 100°F *(38°C)*, contact the factory for assistance.
10. Do not allow the water temperature to drop below 35°F *(2°C)*.
11. Do not allow the flow rate to exceed the maximum rated capacity.
12. **DO NOT ELECTRICALLY CYCLE THE UV UNIT MORE THAN THREE (3) ON/OFF CYCLES IN AN 24-HOUR PERIOD.**
13. Before start up, flush the UV unit and discharge piping to rinse out any debris left from installation.

# Description *of Equipment*

## RBE series

The models in this series contain all electrical components in a Remote Electrical Enclosure. This is ideal for applications where the treatment chamber is outdoors or subject to washdown, etc. All electrical service and instrument monitoring can be done at the remote site.

The Remote Electrical Enclosure contains various electrical components, circuit boards, and all instrumentation. It is connected to the treatment chamber via a flexible, watertight electrical cable.

## treatment chamber

The UV treatment chamber is comprised of one or more multi-lamp cylinders. On either end are gasketed end plates which contain the stainless steel nipples and the lamp socket retainer assemblies.

Inside each cylinder is a helical baffle that prevents laminar flow and maximizes the unit's performance. The quartz sleeves fit inside the UV treatment chamber through the holes in the helical baffle. The lamps fit inside the quartz sleeves. The lamp sockets connect to the lamps, providing a waterproof seal and a vibration-proof grip. The socket covers on either end of the chamber protect the lamp sockets and lamp socket assemblies.

# Warranty *Information*

**To maintain your UV units warranty, please complete and return the Warranty Registration Card located in the back pocket of this manual.**

The following installation and operating conditions are considered hazardous or damaging to the equipment and can compromise the ability of the Aquafine unit to perform as intended.

**ANY OF THE FOLLOWING CONDITIONS WILL VOID THE EQUIPMENT WARRANTY:**

1. Failure to connect proper electrical service to unit.
2. Failure to properly ground the unit.
3. Failure to eliminate excessive vibration, piping movement, or water hammer.
4. Failure to exercise caution in the handling of the sensitive and delicate components (such as lamps, quartz sleeves, electronic boards, etc.) during installation and/or maintenance procedures.
5. Failure to avoid excessive stops and starts. Not more than three (3) on/off cycles per 24 hours of operation.
6. Operation of visibly damaged equipment.
7. Failure to avoid undue overhead piping stress which can result in structural damage to the UV unit. Limit the load to 50 lbs (22.7 kg) per flange.
8. Use of components other than those provided or authorized by Aquafine.
9. Failure to correct overhead piping connection leaks or compression nut seal leaks which result in damage to the electrical components.
10. Operating the unit without water flow.

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# WARRANTY

Aquafine equipment is guaranteed to be free from defects in materials and workmanship (excluding ultraviolet lamps) for a period of one year from the date of purchase. Any part suspected of being defective should be returned prepaid to Aquafine Corporation. If upon our inspection, the part(s) proves to be defective, it will be replaced or repaired (our option) and returned to sender prepaid.

Before returning any part, contact Aquafine Corporation for return authorization and shipping instructions. This guarantee is void if the equipment has not been installed and maintained in accordance with instructions. This guarantee is in lieu of all other warranties, expressed or implied.

To keep your warranty valid and to ensure peak performance, fill out and return your warranty registration card (located in the back pocket of this manual) and use only genuine Aquafine replacement parts.

# Unit Installation

## where to install the unit

Install the UV treatment unit in a horizontal position in a sheltered area with ample ventilation. Ambient temperatures surrounding the unit should be between 35°F (2°C) and 110°F (43°C). For operation below 50°F contact Aquafine. Should your requirements differ, contact the factory for assistance.

As an ultraviolet UV treatment unit does not introduce any chemical residue within the water, it is desirable to install the unit as close as possible to the point-of-use in order to avoid potential recontamination by discharge pipes, fittings, etc. The base of the UV treatment unit should be mounted on suitable support to avoid undue strain on the unit or your related pipes and fittings.

Allow sufficient service access clearance. In making your plumbing connections, provide unions, valves, bypass and drain.

*Depending on the size of the lamp being used, please allow at least 36 inches (92 cm) of clearance for 30-inch units or 72 inches (182 cm) of clearance for 60-inch units on the lamp-changing end of the unit.*

## how to protect your unit

The location should be free from undue vibration which could be caused by proximity to heavy equipment, erratic or improper pumps. Excessive vibration will damage internal electrical components and cause premature failure of the UV lamps.

**Limit overhead piping load to 50 lbs (22.7 kg) per flange.** If your piping system is subject to impulse pressure resulting in a "water hammer" condition, a surge tank or other means must be provided to remove this condition, otherwise the extreme momentary pressure may rupture and fracture the quartz sleeves.

A parts check list was included when this unit was shipped. Please refer to this list and note that some parts are small and can be easily overlooked when discarding packaging.

## operating pressure

Standard units are rated for a maximum operating pressure of 120 psig (8.24 bar).

If your unit has the High Pressure Modification option (model number suffix "HP") operating pressure may increase to 150 psig (10.34 bar).

## heat Sanatization

For heat sanitization (temperatures exceeding 170°F (77°C) up to a maximum of 194°F (90°C)), it is recommended that stainless steel compression nuts be used in place of CPVC compression nuts. During heat sanitization the S-254 probe must be removed. (Adaptor available for maintaining Hydrostatic seal during sanitization.) The selection of the elastomers should be considered.

## remove the plastic dowel(s)

A plastic dowel is placed inside the UV treatment chamber to secure the baffle during shipping. The 30" units have one dowel on the left side only and the 60" units have two dowels -- one on each side.

Remove the compression nut in the twelve o'clock position on the left side of the UV treatment chamber. Remove and discard the plastic dowel. Replace the compression nut. You

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can then proceed with the installation of the quartz sleeves.

## intermittent operation

*Never operate the unit without water flow.* Permanent damage is caused to the UV lamps, electronic ballasts and related components without water flow.

*Operating the ultraviolet unit without water flow through the chamber automatically voids the warranty.*

If operated without water flow, the fluid within the ultraviolet chamber will become hot causing the UV lamps to lose effectiveness. The heat can permanently damage the ultraviolet lamps, UV sensor, the lamp ballast components and related instrumentation.

Should the unit be used for specific batch flow operations, it can be turned "On" and "Off" manually. Make sure the unit is allowed to warm up for at least one minute before use, and make sure the unit is turned "Off" after each session. Do not exceed 3 on/off cycles per 24 hour operation.

If you need help to determine the best method of operating your UV treatment unit under intermittent conditions, contact your local representative or the factory.

An optional Temperature Safety Control Device is available to prevent the overheating problems described above.

## special piping requirements for users of ultrapure water

Ultrapure water users have reported that over time, exposure to ultraviolet light may photochemically degrade nonmetallic piping materials, including most or all fluoro-polymers, resulting in material breakdown and/or structural failure.

Should your water application and piping material be so classified, we recommend you install "UV light traps" to isolate any such susceptible material from direct exposure to the ultraviolet light. Install the UV light trap to the inlet/outlet of the UV treatment chamber prior to the connection of any nonmetallic materials. UV light traps protect nonmetallic piping. Should you require any additional assistance, please contact your local Aquafine representative or the factory directly.

## wiring the unit

Connect the liquid-tight flex conduit, which contains the interconnecting wiring harness, into the remote electrical enclosure through the liquid-tight connector which is provided. Connect the wiring harness to the terminal block starting with terminal block assembly A through terminal block assembly B. (See Wiring Diagram in back pocket of this manual.) Optional equipment connections are made on terminal C. Terminal C blocks are included with optional equipment.

Bring your incoming wiring to the 1/2-inch electrical knock-out in the bottom of the remote electrical enclosure. Make connections to terminal blocks G, N and L. Terminal block L is "hot"; N is "neutral"; and G is the "ground". Make sure your electrical service matches the specifications on the electrical name plate decal on your unit. Locate an "on/off" switch near the unit so the current may be turned off for servicing.

### GROUNDING

IT IS IMPERATIVE THAT THE UNIT BE PROPERLY GROUNDED FOR SAFE AND PROPER OPERATION.

Failure to properly ground the UV treatment unit automatically voids all equipment warranty.

**UV performance is line voltage sensitive. Line voltage should be ±5% of rating shown on the electrical nameplate decal. Voltage outside these limits can reduce the performance of the UV equipment.**

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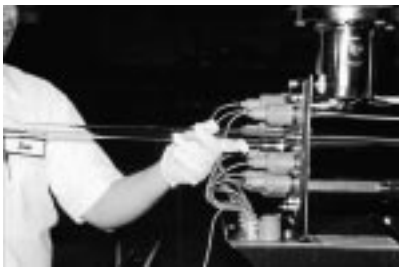
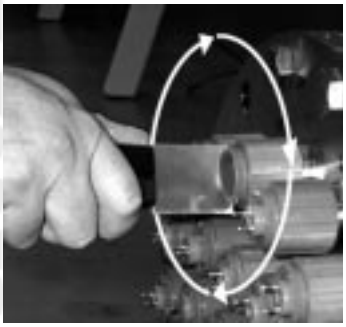
# Installing *the Quartz Sleeves*

*Remove socket covers*



*Place end of quartz sleeve into threaded nipple*

*Compression nut assembled on the quartz sleeve*



*Rotate compression nut clockwise onto the threaded stainless nippled end plate with compression nut tool*

**Please Note:** **Over tightening can break the quartz sleeves or create leaks.**

The procedures on this and the following page apply to Double-Ended (DE), Single-Ended (SE) and High Temperature (HT) RBE units.

## quartz sleeve installation procedures for new equipment

The quartz sleeves designed for this unit are open on both ends. For first time unit installations, follow these quartz sleeve installation procedures:

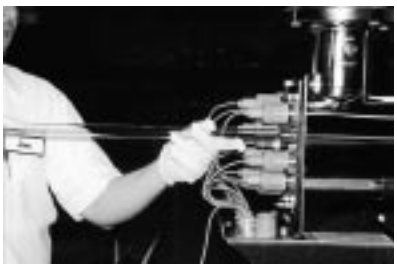
1. Turn off all power to the unit.
2. Wear clean cotton gloves to prevent contamination of the quartz sleeves.
3. Carefully remove each quartz sleeve from the factory packaging. Handle these with care as they are fragile.
4. Visually inspect all quartz sleeves for cracks or other damage. Do not install damaged quartz sleeves.
5. Remove the socket covers on the ends of the treatment chamber.
6. For High-Temperature units, remove the alignment plate from both ends of the unit.
7. Remove all compression nuts and any packaging material from the end plate (if installed).
8. Place the end of the quartz sleeve into the threaded nipple and slowly push the sleeve into the chamber through to the second end plate. Repeat for all quartz sleeves.
9. Install the compression nut and o-ring by placing the o-ring into the internal relief of the compression nut below the threaded area. The o-ring should fit into the compression nut.
10. Place the compression nut and o-ring onto the end of the quartz sleeve until the end of the quartz sleeve touches the end of the compression nut. Some pushing and twisting may be required. Deionized water may be used as a lubricant.
11. Tighten the compression nut approximately 1/2 turn after the threaded nipple and o-ring make contact.
12. Repeat this procedure for the second endplate.
13. Slowly pressurize the system and fill the chamber with water to check for leaks.
14. If there are leaks in any compression nut assembly, depressurize the system and use the compression nut tool to slightly tighten the leaking compression nut assembly.
15. Retest until a leak-free installation is verified.
16. You are now ready to install the UV lamps.

## quartz sleeve replacement procedures for existing equipment

The quartz sleeves designed for this unit are open on both ends. For existing equipment, replace the quartz sleeves as follows:

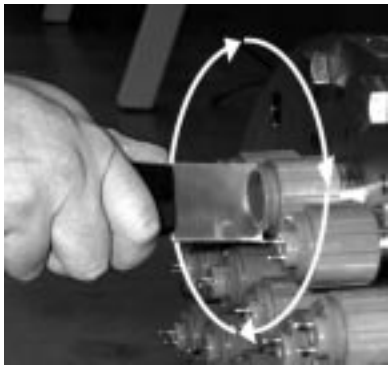
1. Turn off all power to the unit.
2. Depressurize the system and drain the UV unit.
3. Remove the socket covers on the ends of the treatment chamber.
4. For High-Temperature units, remove the alignment plate from both ends of the unit.
5. Remove the existing lamp sockets and compression nuts from the endplate.
6. Wear clean cotton gloves to prevent contamination of the quartz sleeves and UV lamps.
7. Remove the existing UV lamps.
8. Remove the existing quartz sleeves.
9. Carefully remove each new quartz sleeve from the factory packaging. Handle these with care as they are fragile.
10. Visually inspect all quartz sleeves for cracks or other damage. Do not install damaged quartz sleeves.
11. Place the end of the quartz sleeve into the threaded nipple and slowly push the sleeve into the chamber through to the second endplate. Repeat for all quartz sleeves.
12. Install the compression nut and o-ring by placing the o-ring into the internal relief of the compression nut below the threaded area. The o-ring should fit into the compression nut.
13. Place the compression nut and o-ring onto the end of the quartz sleeve until the end of the quartz sleeve touches the end of the compression nut. Some pushing and twisting may be required. Deionized water may be used as a lubricant.
14. Tighten the compression nut approximately 1/2 turn after the threaded nipple and o-ring make contact.
15. Repeat this procedure for the second endplate.
16. Slowly repressurize the system and fill the treatment chamber with water to check for leaks.
17. If there are leaks in any compression nut assembly, depressurize the system and use the compression nut tool to slightly tighten the leaking compression nut assembly.
18. Retest until a leak-free installation is verified.
19. You are now ready to install the UV lamps.

*Remove socket covers*



*Place end of quartz sleeve into threaded nipple*

*Compression Nut assembled on the Quartz Sleeve*



*Rotate Compression Nut clockwise onto the threaded stainless nippled end plate with Compression Nut tool*

Please Note:

**Over tightening can break the quartz sleeves or create leaks.**

# Installing *the Quartz Sleeves*

## USD-RBE Series units only

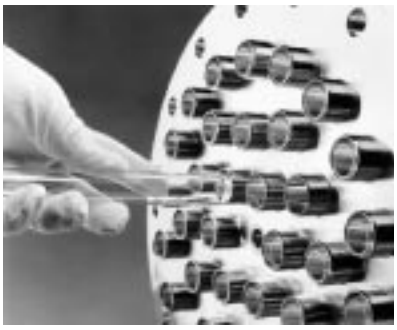
The quartz sleeves for this unit utilize a design that is open on one end and closed on the other end. The closed end of the tube is inserted into the threaded nipple and then through the baffle system in the chamber. Within the baffle, Teflon bushings provide additional support to the quartz sleeves.

### QUARTZ SLEEVE INSTALLATION PROCEDURES

For first time unit installations, follow these quartz sleeve installation procedures:

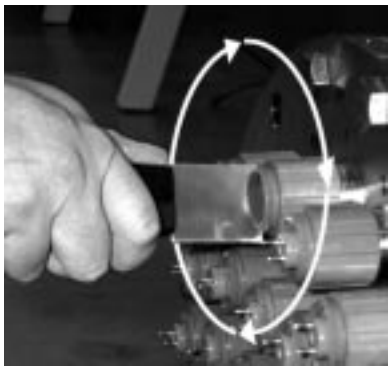
1. Turn off all power to the unit.
2. Wear clean cotton gloves to prevent contamination of the quartz sleeves.
3. Carefully remove each quartz sleeve from the factory packaging. Handle these with care as they are fragile.
4. Visually inspect all quartz sleeves for cracks or other damage. Do not install damaged quartz sleeves.
5. Remove the socket covers on the ends of the treatment chamber.
6. Remove all compression nuts and any packaging material from the end plate (if installed).
7. Place the closed end of the quartz sleeve into the threaded nipple and slowly push the sleeve into the chamber. Some resistance may be felt from the Teflon bushing.
8. Install the compression nut and o-ring by placing the o-ring into the internal relief of the compression nut below the threaded area. The o-ring should fit into the compression nut.
9. Place the compression nut and o-ring onto the end of the quartz sleeve until the end of the quartz sleeve touches the end of the compression nut and hand tighten until snug. Deionized water may be used as a lubricant.
10. Tighten the compression nut approximately 1/2 turn after the threaded nipple and o-ring make contact.
11. Repeat this procedure for all quartz sleeves.
12. Slowly pressurize the system and fill the chamber with water to check for leaks.
13. When applicable, bleed the air from the UV treatment chamber by opening the plug on top of the chamber. Replace with a suitable valve.
14. If there are leaks in any compression nut assembly, depressurize the system and use the compression nut tool to slightly tighten the leaking compression nut assembly.
15. Retest until a leak-free installation is verified.
16. You are now ready to install the UV lamps.

*Stainless socket & lamp end cover design*



*Quartz sleeve installation*

*Compression nut assembled on the quartz sleeve*



*Compression Nut Tool - Rotate clockwise onto the threaded stainless nippled end plate with compression nut tool*

Please Note:

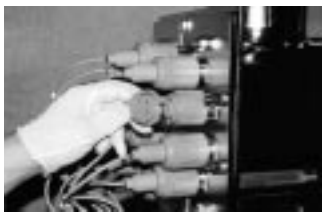
**Over tightening can break the quartz sleeves or create leaks.**

# Installing the Ultraviolet (UV) Lamps

*Insert the lamp into quartz sleeve*

*Lamp locked into compression nut*

*Lamp socket ID number on end plate*



*Firmly connect the lamp pins with the connector*

*Screw the lamp socket cap on*

## single-ended lamp design for units manufactured after January 1, 1999

Once it has been verified that there are no leaks in the system, the UV lamps are ready for installation.

1. Remove all power to the UV unit.
2. Depressurize the system.
3. Wear clean cotton gloves to prevent contamination of the UV lamps**.**
4. Carefully remove each UV lamp from the factory packaging. Handle these with care as they are fragile.
5. Visually inspect all lamps for cracks or damage. Do not install damaged lamps.
6. **Using both hands, slowly insert the lamp into the quartz sleeve by pushing one end of the lamp with one hand, while continuing to support the lamp** *in a level, horizontal position* **with the other hand. This is very important. If not installed properly, lamp or quartz breakage will occur.**
7. Twist the lamp into the locking mechanism of the compression nut. This ensures the lamp is secure within the chamber.
8. Each lamp socket is identified with a number that corresponds to each lamp position marked on the end plate. Match the lamp socket and connect to the appropriate lamp.
9. The two pins in the lamp must be pushed down to fit securely into the pins with the connector.
10. Rotate and screw the lamp socket cap into place. Only hand tightening is required. ***Do not overtighten!***
11. Repeat the procedure above for the second endplate for the non-pin lamp ends. Instead of securing the lamp socket lead assembly to this end of the assembly you will twist on and firmly secure the fixed Compression Nut Cap to the compression nut assembled on the quartz sleeve.

**CAUTION! Prior to energizing the ballasts and lamps, ensure there is no water leaking into the quartz sleeves and compression nut cavities by properly installing these components. Even a small leak can flood a quartz sleeve and compression nut cavity.**

**During operation, high voltage is present at the lamp pins and receptacles of the lamp connectors. Prolonged flooding of a quartz sleeve and compression nut cavity can cause premature failure of the lamp due to repeated arcing, overheating of the lamp connector cable, and may result in a meltdown of the cable insulation.**

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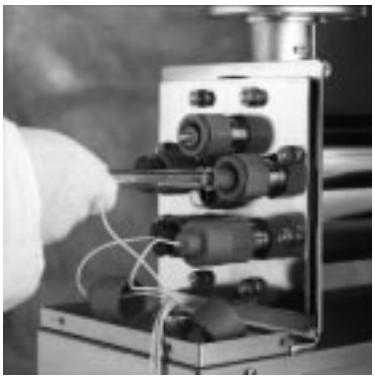
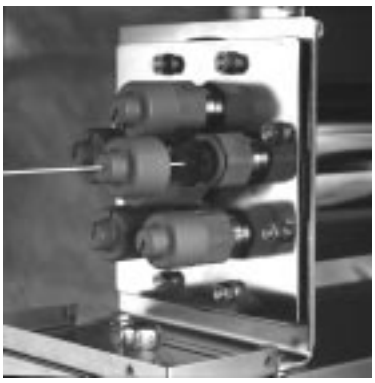
## double-ended lamp design for units manufactured prior to Jan. 1, 1999

1. Remove all power to the UV unit.
2. Depressurize the system.
3. Wear clean cotton gloves to prevent contamination of the UV lamps.
4. Insert one UV lamp into each open quartz sleeve and push it about 2”-3” (51-76mm) out beyond the left compression nut, so as to be able to hold the lamp with your right hand.
5. Unscrew and pull back the retainer cap from the rubber lamp socket.
6. Insert the lamp base into the rubber socket. Push until you feel a firm “bottomed out” connection.
7. Carefully slide the rubber boot portion of the lamp socket over the end of the lamp. **CAUTION: DO NOT INSERT UV LAMPS WITH OPPOSING RETAINER CAP IN PLACE. Verify no portion of the rubber boot has folded under during this process.**
8. Screw the slotted retainer cap clockwise onto the compression nut, making sure the number on the socket lead wire and the end plate correspond.
9. Connect the right side rubber lamp sockets and spring-loaded lamp socket retainer assemblies onto each lamp. Pay special attention to match the numbers on the retainer assemblies with the numbers beside each steel nipple on the end plate.
10. Carefully pull out each rubber lamp socket from each spring-loaded socket retainer assembly.
11. With one hand, push the rubber socket boot onto the end of each ultraviolet lamp. When properly attached, a slight “snap” can be felt, which indicates a proper connection.
12. Carefully slide each lamp socket retainer assembly up and over the rubber lamp socket boot, until the retainer assembly reaches the male-threaded portion of the compression nut.
13. Then, turn clockwise until the socket retainer cap bottoms out against the compression nut. Avoid overtightening.



*Insert Lamp Base into Quartz Sleeve*



*Screw the slotted Retainer Cap onto the Compression Nut*

*Lamp socket ID number on End Plate*

**CAUTION! Prior to energizing the ballasts and lamps, ensure there is no water leaking into the quartz sleeves and compression nut cavities by properly installing these components. Even a small leak can flood a quartz sleeve and compression nut cavity.**

SAFETY ISSUE

**During operation, high voltage is present at the lamp pins and receptacles of the lamp connectors. Prolonged flooding of a quartz sleeve and compression nut cavity can cause premature failure of the lamp due to repeated arcing, overheating of the lamp connector cable, and may result in a meltdown of the cable insulation.**

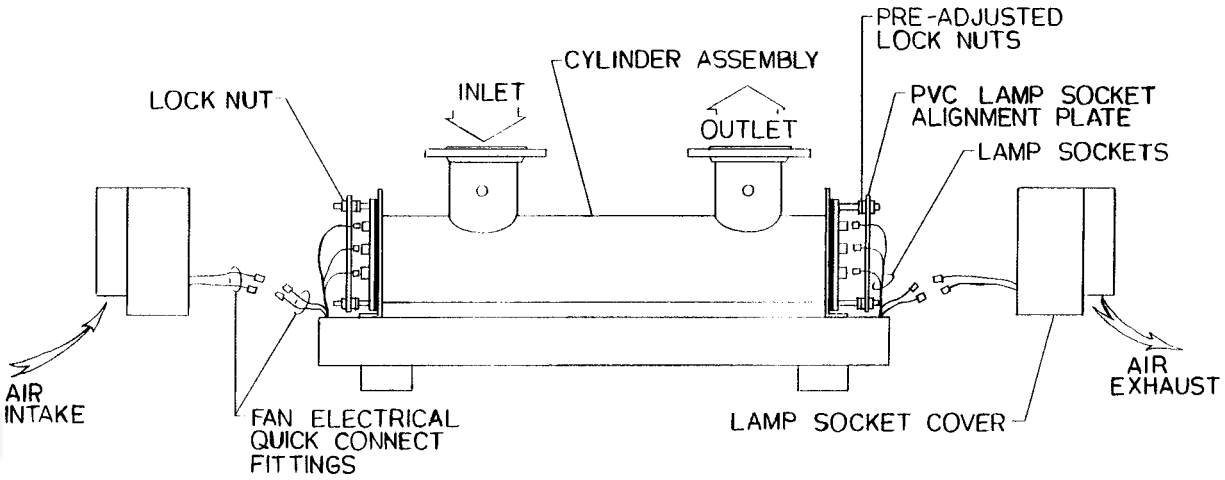
# more **Installing** *the Ultraviolet (UV) Lamps*

## high-temperature (HT) units

Once it has been verified that there are no leaks in the system, the UV lamps are ready for installation.

1. Remove all power to the UV unit.
2. Depressurize the system.
3. Wear clean cotton gloves to prevent contamination of the lamps.
4. Carefully remove each UV lamp from the factory packaging. Handle these with care as they are fragile.
5. Visually inspect all lamps for cracks or damage. Do not install damaged lamps.
6. Using both hands, slowly insert the lamp into the quartz sleeve by pushing one end of the lamp with one hand, while continuing to support the lamp ***in a level, horizontal position*** with the other hand. This is very important. If not installed properly, lamp or quartz breakage will occur.
7. Place the PVC alignment plate on one end and secure in place with locknuts.
8. Guide each lamp into the lamp socket, making sure you have a firm and complete connection.
9. Place the PVC alignment plate on the opposite end of the disinfection chamber and align, making sure you have a firm connection of all lamps and lamp sockets, then secure the PVC alignment plate into position with the locknuts. Should you find the UV lamp failing to operate, the cause will generally be attributed to an improper lamp socket connection.
10. Place each socket cover near the ends of the disinfection unit and connect the two fan wires with the two power wires supplied from the unit base. Secure the socket cover to the disinfection cabinet with the screws that are provided.

**CAUTION! Do not look at lighted blue ultraviolet lamps. Do not operate ultraviolet lamps outside the treatment chamber. Severe irritation to the eyes and skin will result.**




*Aquafine High-Temperature UV Unit*

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# Installing *the Ultraviolet (UV) Lamps*

## USD-RBE Series units only

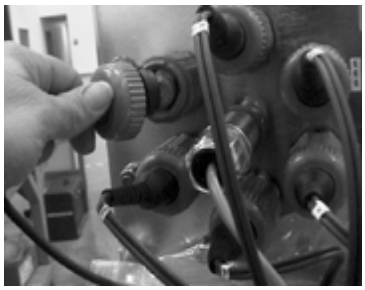
Once it has been verified that there are no leaks in the system, the UV lamps are ready for installation.

1. Remove all power to the UV unit.
2. Depressurize the system.
3. Wear clean cotton gloves to prevent contamination of the UV lamps.
4. Carefully remove each UV lamp from the factory packaging. Handle these with care as they are fragile.
5. Visually inspect all lamps for cracks or damage. Do not install damaged lamps.
6. Using both hands, slowly insert the lamp into the quartz sleeve by pushing it with one hand while guiding it with the other ***in a level, horizontal position.*** This is very important. If not installed properly, lamp or quartz breakage will occur.
7. Twist the lamp into the locking mechanism of the compression nut. This ensures the lamp is secure within the chamber.
8. Each lamp socket is identified with a number that corresponds to each lamp position marked on the end plate. Match the lamp socket and connect to the appropriate lamp.
9. The lamp pins must be pushed down to fit securely in the lamp socket connector.
10. Rotate and screw the lamp socket cap into place. Only hand tightening is required. ***Do not overtighten!***

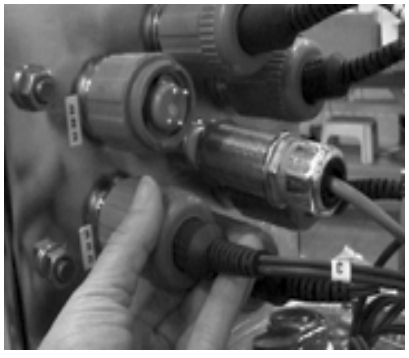
*Insert the lamp in a level, horizontal position.*

*UV Lamp securely inside locking mechanism*

*Lamp socket ID number on end plate*



*Secure lamp socket connector to lamp*



*Screw the lamp socket cap into place*

**CAUTION! Prior to energizing the ballasts and lamps, ensure there is no water leaking into the quartz sleeves and compression nut cavities by properly installing these components. Even a small leak can flood a quartz sleeve and compression nut cavity.**

**During operation, high voltage is present at the lamp pins and receptacles of the lamp connectors. Prolonged flooding of a quartz sleeve and compression nut cavity can cause premature failure of the lamp due to repeated arcing, overheating of the lamp connector cable, and may result in a meltdown of the cable insulation.**

# Powering Up *the Ultraviolet (UV) Unit*

## prior to turning on the UV unit, the following must be verified:

- With water flowing through the system, ensure that there are no system leaks and no piping connection leaks.
- All earth ground connections are properly made.
- All lamp connections are properly made.
- The socket covers are secured to both ends of the UV treatment unit.

1. Verify that all incoming power conductors, including the ground conductor, are properly terminated.
2. Turn on the electrical power to the UV unit.
3. Observe the UV Lamp Operational Display panel. All yellow lights produce a steady glow after 3 minutes time. Operate 10 more minutes and recheck. The UV unit is now ready for operation.

**Turn the power off until actual operational start-up begins.**

**CAUTION! Rapid successive cycling of the power to the ballasts can cause premature failure of the system components.**

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# Monitoring *Devices*

*UV Lamp Operational Display Panel*

## UV lamp operational display panel

To verify that all the UV lamps are operating properly, your UV treatment unit has been provided with a UV Lamp Operational Display Panel. The panel consists of as many LED indicators as there are ultraviolet lamps. Each LED indicator is electrically connected to the lamp circuitry of a specific UV lamp. The LED indicators are intended to operate “on” when the UV lamps are also turned “on”.

Should any UV lamp fail to operate electrically, the corresponding LED will automatically turn “off”.

Each UV lamp is numbered at the end of the UV treatment chamber, and the corresponding LED light carries the same number on the display panel; thus, if one or more LED lights fail to operate, you can easily determine which specific lamp requires attention.

We recommend you monitor the LED Panel daily to ensure proper performance**.**

*Running Time Meter*

## running time meter

Your ultraviolet treatment unit has been furnished with a Running Time Meter, located on the front instrument panel. This non-resettable running time meter will log up to 99,999 hours. It is intended to remind you of the number of operating hours on the equipment, as certain maintenance functions need to be performed at certain time intervals.

A maintenance log is attached to the unit for your use. It should be kept current. This provides an immediate maintenance reference: when it was performed and when the next service is due. Additional service logs are available from Aquafine, and are intended to be placed on top of the existing service logs.

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## model S-254 UV optical sensor option

The optional S-254 UV optical sensor measures the relative output of ultraviolet light within the UV treatment chamber. Degradation of the UV lamps, fouling of the quartz sleeves, water temperature fluctuation and increased turbidity of the water will all affect the sensor reading.

The UV meter assembly and instrumentation setpoint potentiometers are located on the front of the electrical enclosure. The peripheral alarm contacts are accessible from the back side of the meter. A shielded signal cable connects the sensor meter assembly to the sensor probe. The sensor probe is located in the sensor port fitting on the top of the UV treatment chamber in Double-Ended, High-Temperature (HT) units and in the endplate in Single Ended units.

All S-254 UV optical sensors are tested and preset at the factory in free air. Setpoint adjustments are required at installation and after each subsequent lamp changeout cycle.

### SETTING THE UV METER

1. Gradually start the normal flow rate.
2. Bring the unit up to normal operating pressure.
3. Turn the UV lamps on for a minimum of 15 minutes.
4. Adjust the potentiometer sensitivity to 100%.
5. Adjust the potentiometer sensitivity to 50%.
6. Adjust the potentiometer alarm until the red LED barely comes on.
7. Set the potentiometer sensitivity back to 100%.

*S-254 UV Optical Sensor*

8. Turn the potentiometer sensitivity to 50%; the red LED should come on.
9. Turn the potentiometer sensitivity back to 100%.

**Re-calibration must be performed after the first 100 hours of operation on new UV lamps, both at the time of installation and each time the UV lamps are replaced.**

### ALARM CONTACTS (optional)

Normally Closed and Normally Open alarm contacts are also provided for use with user-supplied peripheral equipment, such as remote alarms or solenoid valves. Dry relay contacts are rated as follows: 0.52 AMP 120 VAC., 0.25 AMP 240 VAC

If your application requires higher contact ratings, use a slave relay. Connection of peripheral equipment is the responsibility of the user.
See the wiring schematic in back pocket of this manual

### SENSOR ALARM

The S-254 UV optical sensor provides information about the relative amount of UV passing through the water. The reading is affected by quartz sleeve fouling and/or the germicidal lamp efficiency. The UV sensor is sensitive to, and reflects changes in, UV transmission when a substantial change occurs in the normal operating flow rate, temperature, operating pressure, or quality of the fluid flowing in the system.

When the UV intensity falls below the minimum standard due to any of the above conditions, the sensor alarm light (red LED) will come “on” and corrective action must be taken to optimize the performance of the UV treatment unit.

1. Examine your system for any significant changes in normal operating conditions.
2. Check if all UV lamps are electrically operating and/or need replacement. Verify the quartz sleeves are clean.

If quartz sleeve fouling has caused the optical sensor alarm to activate, the quartz sleeves must be cleaned. At the same time, you must clean the sensor probe quartz window. Please find this information in the maintenance section of this manual.

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## temperature safety control option*

The Temperature Safety Control consists of a heat-sensing probe. This device protects against inadvertent overheating inside the UV chamber, which can damage the UV lamps and the ballast/LED Display Panel circuitry.

The Temperature Safety Control senses raised water temperature and assumes the UV lamps are operating "on" with no water flow.

### STANDARD UNITS

The device automatically turns the UV lamps off when the water temperature reaches 120º F (49ºC) and automatically turns the UV lamps back on when the temperature falls to 100º F (38ºC). This feature is optional on all standard RBE models.

### HIGH-TEMPERATURE (HT) UNITS

The device automatically turns the UV lamps "off" when the water temperature reaches 170ºF (77ºC) and automatically turns the UV lamps back "on" when the temperature falls to 150ºF (66ºC).

This temperature spread prevents excessive stop/starts during no flow conditions, and it protects the UV lamps and the electrical components from overheating damage.

The temperature probe is located in the end plate. No operator intervention is required other than periodic visual verification that the UV lamps (LED Display Panel) are properly operating during normal water flow conditions.

* This feature is standard on all High Efficiency (HE) units.

## lamp-out alert indicator option

Lamp Out Alert is an optional accessory package that activates a relay when a UV lamp fails to operate. A visual inspection of the LED UV Lamp Display Panel will indicate which lamp has failed. Dry contacts are provided for customer connection. The dry contacts are rated at 3.0 Amps maximum @ 120 volts.

Wire color codes:

Green = Normally Closed
White = Common
Yellow = Normally Open

## 4-20 mA sensor signal option

This option works with the optional S-254 optical sensor. It generates a 4-20 mA output signal based upon the relative UV intensity which may be monitored at a remote control panel or control PC. The customer is responsible for providing an appropriate 4-20 mA display instrument and connecting it.

**It is essential that all non-operational lamps be changed immediately to maintain system efficiency.**

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# Troubleshooting

## using the LED display

If an LED bulb does not light after you replace a UV lamp, you need to verify the electrical output of the ballast connected to that specific UV lamp. This is done by testing the ballast open circuit voltage. This should be done by an electrician or qualified facilities personnel. Follow these recommended procedures:

1. Turn power “off” to the UV unit.
2. Remove the socket cover.
3. Identify the “faulty” UV lamp which corresponds to the number on the LED display.
4. Remove the lamp socket(s) from the “faulty” UV lamp base.
5. Use a voltmeter and set an operating range at >700 VAC.
6. Measure the open circuit voltage:

   **For single-ended (SE) UV lamps:** connect the voltmeter across the receptacles of the lamp socket.

   **For double-ended (DE) and high temperature (HT) UV lamps:** connect one end of the voltmeter to one end of the lamp socket and the other end of the voltmeter of the opposite end of the lamp socket.
7. Turn power “on” to the UV unit.
8. Record the reading.
9. Turn power “off.”
10. Listed below please find the open circuit voltages for the various ballasts:

| Ballast type | | |
|---|---|---|
| 120 Volt Electronic | 240 Volt Magnetic | 240 Volt HE |
| 550-650 | 575-675 | 450-660 |

If the voltage reading is zero or a number above or below the acceptable ranges, this indicates a ballast fault, and the ballast connected to the “faulty” UV lamp must now be replaced.

If the voltage reading is within acceptable ranges but the LED does not light, the LED board has failed and needs to be replaced.

Refer to the Replacement Parts Lists in the back of this manual to identify the proper ballast and/or LED part number.

*UV Lamp Operational Display Panel*

**CAUTION! Avoid touching the lamp tip after you remove the lamp socket. This is a shock hazard.**

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# Maintenance *Requirements*

## cleaning the unit

The exterior surfaces of the Aquafine UV unit should be kept clean as part of routine maintenance. Use a soft cloth with soap and water or any commercial stainless steel cleaner. Avoid scratching the Lexan instrument window.

## LED status display panel

Monitor the Status Display LED Panel daily. Immediately replace any failed UV lamp.

## UV lamp replacement

Replace Standard UV lamps after 8,000 hours of use. Replace High Efficiency (HE) UV lamps after 8,000 hours of use.

THIS IS BASED ON NO MORE THAN 3 ON/OFF POWER CYCLES PER 24 HR. PERIOD.

Please follow all operating requirements outlined in the warranty section of this manual.

Premature lamp failure or lamp life deterioration can be expected if the UV unit is cycled on/off more than three (3) times a day. To replace the lamps, follow the procedures on pages 11-14.

**CAUTION! Prior to removing the socket cover to access the lamps and quartz sleeves, you must release all pressure to the UV treatment chamber. Drain the chamber if required. Do not stand in a direct line with the endplate; observe from the front or**

## quartz sleeve cleaning & replacement

As water passes through the ultraviolet treatment unit, minerals, debris and other substances in the water will settle and deposit onto the quartz sleeve. This will impair the ability of the ultraviolet rays to penetrate the water.

Recent studies have shown that degradation of the quartz sleeve from continuous exposure to UV reduces the amount of UV radiation transmitted into the water stream. Based on these findings, we recommend the annual replacement of the quartz sleeves in addition to routine cleaning.

## cleaning the quartz sleeves

Visually inspect a quartz sleeve thirty days after use to see if any debris or film has settled on the outside. If dirty, follow these procedures:

1. Turn off the water to the unit.
2. Disconnect the electrical circuit.
3. Drain the UV treatment chamber.
4. Wear clean cotton gloves to prevent contamination of the quartz sleeves and UV lamps.
5. Remove the retainer caps and lamp sockets.
6. Remove the ultraviolet lamps from inside the quartz sleeves.
7. Using the appropriate compression nut tool, loosen the compression nuts and carefully remove the quartz sleeves.
8. Wash the quartz sleeves with mild soap and water and rinse with clean, hot water.

Should this be insufficient to clean the quartz sleeves, they should be replaced. To place an order, contact Aquafine or your local representative. To replace the quartz sleeves, follow the procedures on pages 8-10.

## cleaning the sensor probe window

1. Shut off the flow and release the pressure.
2. Shut off all power to the UV unit.
3. Remove the coaxial cable by pushing and twisting the BNC terminal counterclockwise. The connector will slide off.
4. Twist and pull the probe from the sensor fitting.
5. Use a lint-free cloth with alcohol and very carefully wipe the lens face on the front of the probe. Failure to do so may result in false readings.

# more **Maintenance** *Requirements*

6. Replace the probe and the coaxial cable.
7. Turn the power "on" and resume operation. Whenever new lamps have been installed, follow all resetting instructions.

## measuring performance

Every UV treatment unit should be tested periodically to verify actual efficiency. Regardless of the intended application or any optional equipment which may have been provided with your UV unit, the most accurate and dependable procedure is to conduct post-UV sample analysis in accordance with standard testing methods.

Periodic sample collection and testing should be scheduled as often as the user deems sufficient to be assured the quality of the Aquafine ultraviolet unit effluent is acceptable.

## obtaining proper water samples

Our experience has shown that the vast majority of unsatisfactory post-UV bacteriological samples are directly related to improper sample-taking techniques.

There are a variety of commercial sample collection apparatuses available, and should you choose one, be sure to follow the manufacturer's recommended procedures.

We have provided 1/4" NPT threaded fittings on both the intake and discharge UV chamber flange risers. We recommend you use these fittings to collect "before and after UV" water samples to eliminate the possibility of contamination by nearby piping, fittings, etc.

We recommend you select a valve with a discharge orifice no larger than 1/4" (6 mm).

## sampling procedures

The following procedure is recommended for collecting samples for bacteriological analysis when sample valves are installed:

1. Prior to taking the water sample, have on hand an adequate supply of sterile bottles. These should be obtained from a source laboratory and should have been autoclaved and contained within a plastic outer wrapping.
2. The inside diameter of a sample valve must not exceed 1/4" (6 mm) to ensure proper velocity. Prior to taking the sample, it is imperative that the test sample valve be fully opened under full pressure for a full three and one half minutes. Temporary tubing or some other material may be used to direct the water to a container or drain to avoid unnecessary spillage.
3. After the valve has been left fully open for three and one half minutes, reduce the flow to a reasonable stream of water (not less than 50% of full flow). Continue flowing to drain three additional minutes.
4. Remove any temporary tubing used for flow diversion.
5. Open the sterile bottle. Holding the cap in a down position, the operator should then hold his breath while taking the sample so as to avoid atmospheric contamination of the sample. The operator must also not allow his finger to touch the inside of the cap or the neck of the bottle.
6. After the water sample has been taken, the cap should be immediately secured on the sample container.
7. The sample container should be labeled and placed in a plastic wrapping and must be taken to the laboratory for plating as soon as possible. Processing should begin within three hours of sample collection and should comply with accepted standard methods.

The above procedure was developed by a leading national pharmaceutical firm after an 18-month study. It has been found that virtually all removable debris which may accumulate within a sample valve can be mechanically flushed during the procedures detailed above.

We recommend duplicate samples be taken at each test station, during each specific test, to avoid laboratory error and to ensure reasonable repeatability and validity through comparison.

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# more **Maintenance** *Requirements*

*Ballast connectors*

## ballast replacement

Ballast replacement is not part of the UV unit's routine maintenance. However, in the event that a ballast needs to be replaced, the following procedure should be followed:

1. Power down the UV unit by turning the unit isolator switch, if installed, to the "OFF" position. If not, ensure that power to the unit is removed by opening the switch or breaker upstream of the UV unit.
2. Locate the old ballast to be replaced. Refer to the electrical diagram, if necessary.
3. Isolate the old ballast from rest of system by disconnecting the ballast connector.
4. Using 5/32 L-shaped hex wrench completely remove the bolt securing the ballast to the sub panel. Put the bolt aside.
5. Remove the old ballast by pulling it towards you. Discard the old or defective ballast.
6. Install the new ballast, securing it with the bolt removed earlier.
7. Tighten the bolt with 5/32 L-shaped hex wrench.
8. Reconnect ballast connector(s).
9. Restore the power to the UV unit by turning the unit isolator switch to the "ON" position or by closing the upstream switch or breaker.

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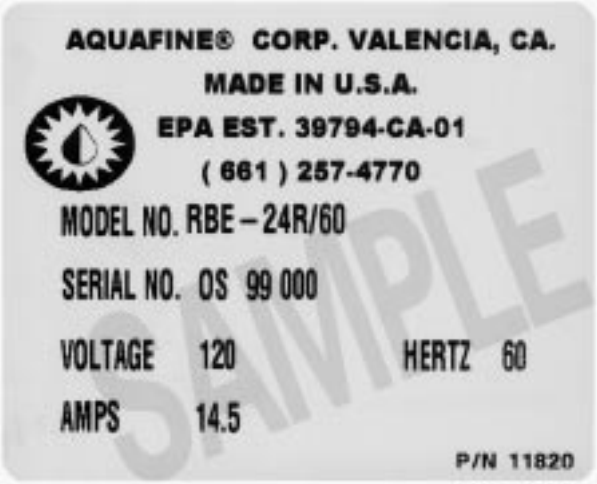
# Replacement *Parts List*

Please Note:

Refer to this nameplate decal on your unit when ordering parts or service.




## general part description ..... part number

### GENERAL

1. O-rings - EPDM ..... 4253
2. O-rings - Silicone ..... 12967
3. O-rings - Viton ..... 40413
4. O-rings - Chemraz ..... 16600
5. Ballast - 120 Volt ..... 16518
6. Ballast - 240 Volt ..... 19721-2
7. Fan 120 - Volt ..... 3901
8. Fan 240 - Volt ..... 3903
9. RBE-4R & 6R Cylinder Gasket
   - Silicone ..... 12131
   - EPDM ..... 3118
   - Goretex ..... 16251
   - Viton ..... 16673
10. RBE-8R through RBE-24/60 Cylinder Gasket
    - Silcone ..... 12312
    - EPDM ..... 3244
    - Goretex ..... 16252
    - Viton ..... 16674
11. T-120 Temperature Switch ..... 18545

### DOUBLE-ENDED UNITS

12. UV Lamps DE Standard 254-Mauve
    Disinfection and Ozone Destruction Applications
    - Size: 30” Length ..... 3084LM
    - Size: 60” Length ..... 3098LM

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# more **Replacement** *Parts List*

double-ended units cont. ..... part number

13. UV Lamps DE Standard 185-Blue
TOC Reduction Applications
Size: 30" Length ..... 3087
Size: 60" Length ..... 3095

14. UV Lamps DE Validated 254-Green
Disinfection and Ozone Destruction Applications
Size: 30" Length ..... 16676
Size: 60" Length ..... 16677

15. UV Lamps DE Validated 185-Yellow
TOC Reduction Applications
Size: 30" Length ..... 16678
Size: 60" Length ..... 16679

16. Quartz Sleeves - Open End
Size: 30" length ..... 3184
Size: 60" length ..... 3198

17. Lamp Socket - 30" Lead Wires ..... 16184
Lamp Socket - 90" Lead Wires ..... 16184-1

18. Socket Lok™ Assembly Kit ..... 13899

19. Compression Nut - CPVC ..... 12422

20. Compression Nut - 316L Stainless Steel ..... 16898

21. Compression Nut Spring ..... 12423

22. Compression Nut Spring End ..... 12421

23. Compression Nut Cap, Fixed ..... 12420

24. Compression Nut Tool ..... 3105

## SINGLE-ENDED UNITS

25. UV Lamps SE Standard 254-Mauve
Disinfection and Ozone Destruction Applications
Size: 30" Length ..... 17491
Size: 60" Length ..... 17998

26. UV Lamps SE Standard 185-Blue
TOC Reduction Applications
Size: 30" Length ..... 18977-3
Size: 60" Length ..... 18977-4

27. UV Lamps SE Validated 254-Green
Disinfection and Ozone Destruction Applications
Size: 30" Length ..... 18059
Size: 60" Length ..... 18060

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# Replacement *Parts List*

single-ended units cont. ..... part number

28. UV Lamps SE Validated 185-Yellow
    TOC Reduction Applications
    Size: 30" Length ..... 18977-7
    Size: 60" Length ..... 18977-8

29. UV Lamps SE-HE 254-Cyan
    Disinfection and Ozone Destruction Applications
    Size: 60" Length ..... 18024

30. UV Lamps SE-HE 185 Violet
    TOC Reduction and Chlorine/Chloramine Destruction Applications
    Size: 60" Length ..... 17820

31. UV Lamps SE-HE Validated 254-Black
    Disinfection and Ozone Destruction Applications
    Size: 60" Length ..... 18951

32. UV Lamps SE-HE Validated 185-Orange
    TOC Reduction and Chlorine/Chloramine Destruction Applications
    Size: 60" Length ..... 18953

33. Quartz Sleeve - Open End
    Size: 30" Length ..... 18347
    Size: 60" Length ..... 18348

34. Lamp Socket - 30" Lead Wires ..... 40569-3
    Lamp Socket - 90" Lead Wires ..... 40569-8
    Lamp Socket - 16´ Lead Wires ..... 40569-16

35. Ballast, HE, 240 Volt ..... 40328

36. Compression Nut - CPVC ..... 17496
    Compression Nut - 316L Stainless Steel ..... 18468

37. Compression Nut Cap, Fixed ..... 17489-1

38. Compression Nut Tool ..... 18517

39. Lamp Socket Cap ..... 17489

40. S-254 Sensor Probe
    RBE (1- to 12-lamp units) ..... 18176-1
    RBE-HE (4- & 6-lamp units) ..... 18176-1
    RBE-HE (8-, 10- & 12-lamp units) ..... 18176-3
    RBE-USD (1- to 12-lamp units) ..... 18176-4

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# more **Replacement** *Parts List*

single-ended units cont. ..... part number

## HIGH-TEMPERATURE (HT) UNITS

41. Lamp Socket ..... 15596

42. Lamp Socket Assembly for HT unit ..... 13899

43. UV Lamps - High Temperature (HT) Standard 254-Mauve
    Disinfection and Ozone Destruction Applications
    Size: 30" Length ..... 3089
    Size: 60" Length ..... 3099

44. Quartz Sleeve - Open End
    Size: 30" Length ..... 3184
    Size: 60" Length ..... 3198

45. Compression Nut Tool ..... 3105

46. T-120 Temperature Control Switch ..... 17803

## USD-RBE SERIES UNITS

47. Quartz sleeves, domed-end
    Size: 30" Length ..... 18057
    Size: 60" Length ..... 17751

48. Teflon Quartz bushing ..... 17490

49. Cylinder O-ring, USD-RBE-4R and -6R
    Silicone ..... 40533
    EPDM ..... 40486
    Viton ..... 40485

50. Cylinder O-ring, USD-RBE-8R through -24R/60
    Silicone ..... 40534
    EPDM ..... 40456
    Viton ..... 40496

Note: Some units are factory supplied with stainless steel NPT threaded closure plugs to seal the 1/4" sample ports. Teflon tape is temporarily applied to facilitate this threaded seal.